FRONTLINE BIOENERGY, LLC

Capture the energy ⚡ Release the potential

San Joaquin Renewables ("SJR"): Carbon Negative Renewable Natural Gas via Gasification of Ag Waste

tcbiomass conference

April 20, 2022

Kenton Guilbert presenting on behalf of Jerod Smeenk

Presentation Topics

- Frontline BioEnergy's Technology
- SJR Project Highlights
  - BioEnergy with Carbon Capture and Storage ("BECCS")
  - Current Status and Next Steps
- Project Development
  - Challenges
  - Lessons Learned

About Me

- Master of Science, Carnegie Mellon (but not really)
- Renewable Energy Experience
  - 12 years with Center T Advisors
  - CFO of Solar Energy Infrastructure Venture
  - Multiple Financings
- Relationship with Frontline BioEnergy spans 3+ years

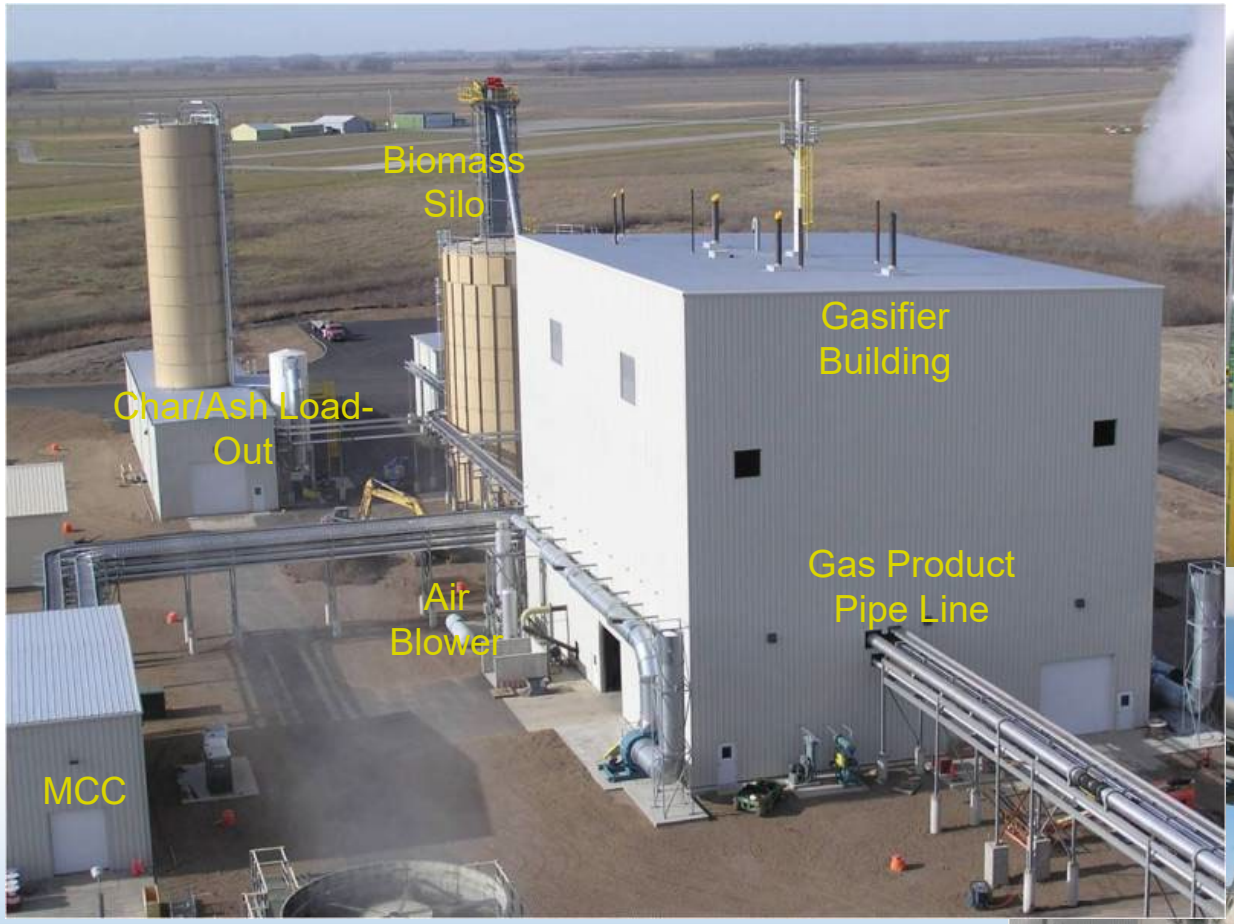
Frontline BioEnergy – Fueling the Energy Transition™

- **Technology & project development firm founded in 2005**
- **Owns and licenses proprietary pressurized gasification and gas clean-up technology**
  - TarFreeGas® patented fluidized bed converter:
    - Pressurized bubbling and fast-fluidization bed designs
    - Up to 99% tar conversion
    - Air or oxygen/steam gasification
  - PMFreeGas® patented high efficiency pressurized gas filtration:
    - ~99.999% of particulate matter: <2 mg/Nm^3
- **Sub-license for auto-thermal pyrolysis technology from Iowa State University**

Frontline BioEnergy – Fueling the Energy Transition™

- **Projects**
  - Partner with developers and EPC firms to deliver an integrated waste management, energy, fuel, chemical, and/or renewable product solution
  - Chippewa Valley Ethanol Company: 75 tpd as-operated (expandable to 300 tpd) biomass-to-boiler fuel plant in Minnesota
  - Providing technology license and engineering services to a major biofuel project in the western U.S.
  - Providing technology license and engineering services to a renewable natural gas project in Canada
  - Stine Seed Farms: EPC of a 50 tpd biomass pyrolysis demonstration plant

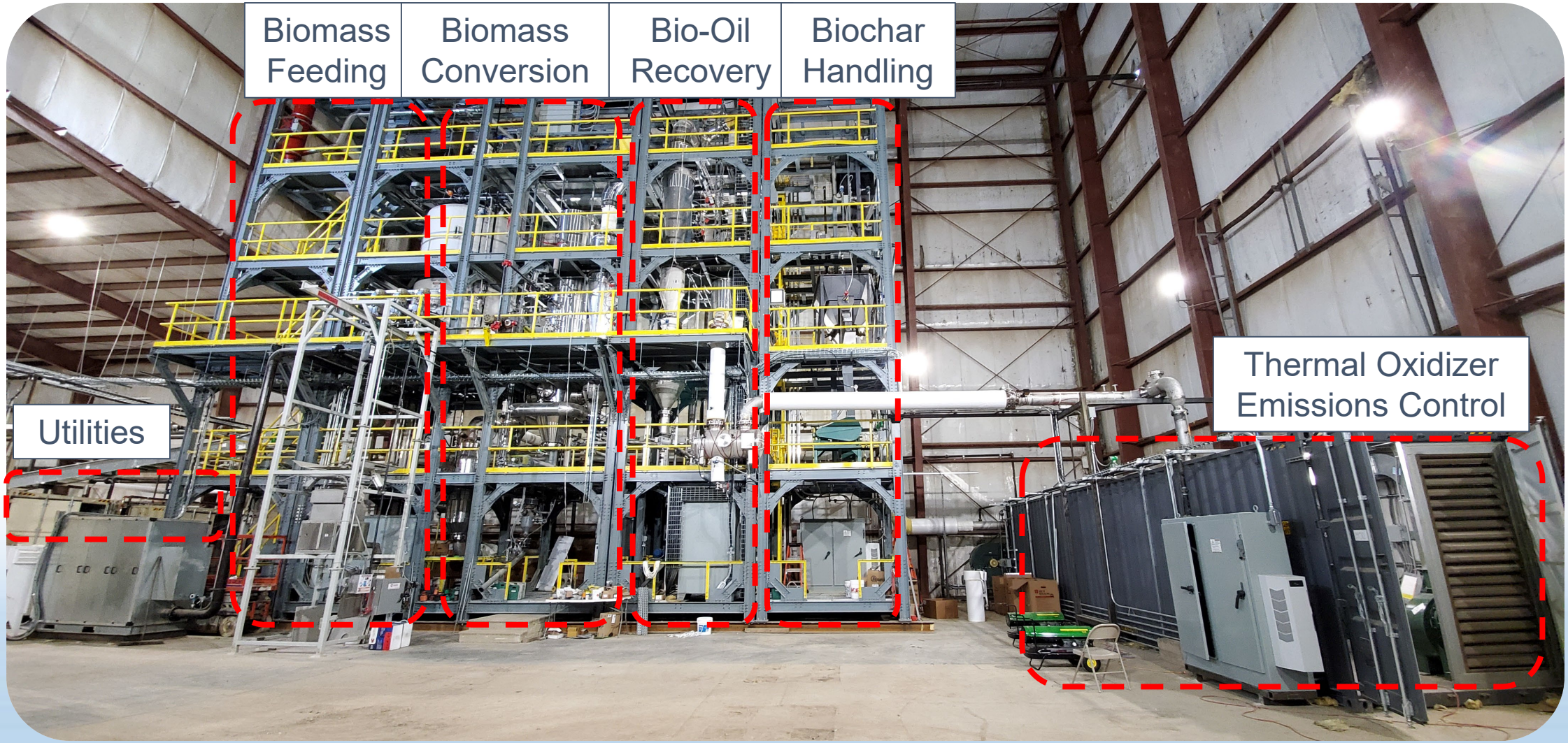
CVEC Gasifier using PMFreeGas®



Located at Chippewa Valley Ethanol Company in Benson, MN

Phase 1: 75 TPD input (12.5 MW_{th})

Stine Seed Farms 50 tpd Pyrolysis Plant



Frontline Offers a Platform Gasification Technology

Enormous Flexibility: BECCS Technology is easily adapted to a *very* wide range of feedstocks and products, including:

Feedstocks


Biomass

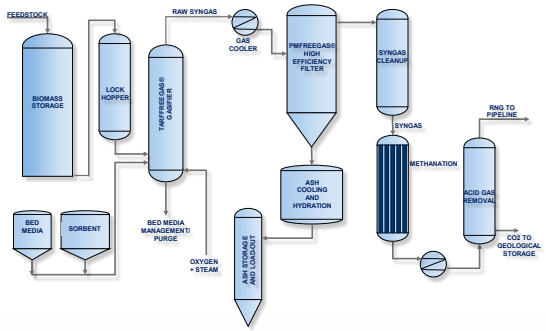

Waste


Wood Waste


RDF Pellets


Agri-Waste

Frontline's BECCS Technology

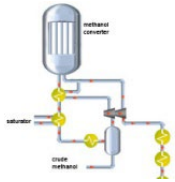


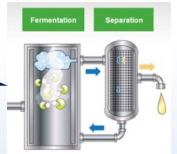
Products

Pipeline Quality Synthetic Natural Gas Production

Hydrogen Production

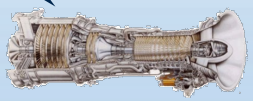
Drop-in hydrocarbon fuels via FT

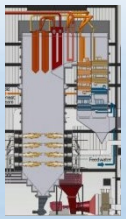

Methanol & Dimethyl Ether Synthesis



Syngas Fermentation (EtOH)

Reciprocating Engine, IGCC


Combustion Turbine, IGCC


Boilers

San Joaquin Renewables
NATURAL GAS FROM BIOMASS

- **Frontline is leading development**
  - Produce approximately 10-million scf of RNG for export per day
  - $165 million of project equity secured
  - Detailed engineering underway
  - Permits submitted for agency review
  - Pilot plant testing later this year

San Joaquin Renewables

NATURAL GAS FROM BIOMASS

- **Frontline BING™ process**

  Biomass-Into-Natural Gas
- **Produce RNG with a carbon intensity of -115 gCO2e/MJ**
- **Will be one of the first BECCS projects in CA**
- **Will create 125 jobs in an economically depressed region**
- **Air quality benefit equivalent to eliminating the NOx emissions from 2,400 diesel trucks**

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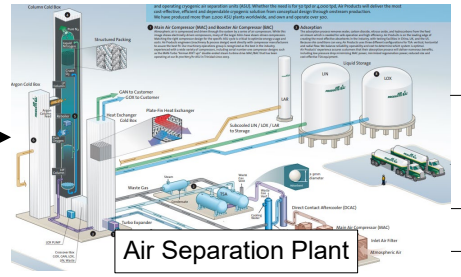
Frontline's BING™ Process

AIR



Air Separation Plant

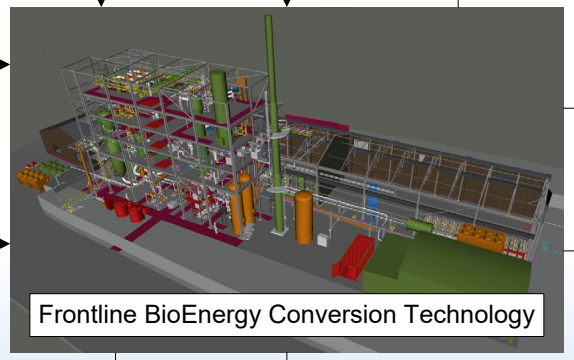
ARGON to Industry

OXYGEN

NITROGEN

VENTED NITROGEN

BIOMASS

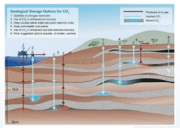


Frontline BioEnergy Conversion Technology

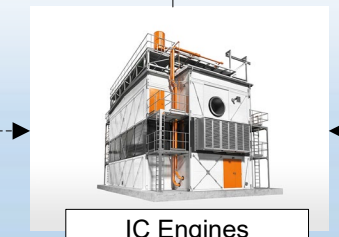
RNG to Pipeline for Transporation

POWER

CO2 to Sequestration



NATURAL GAS



IC Engines

Fuel Cells

BIOCHAR to Land Application

Ammonium Sulfate Fertilizer

San Joaquin Renewables

NATURAL GAS FROM BIOMASS

- **Annually the project will**
  - consume 400,000 tons/year of ag waste
    - 320,000 dry tons/yr of orchard wood waste
    - 80,000 dry tons/yr of nut shells
  - consume no water
  - produce 29 million gasoline-gallon equivalents of pipeline-quality renewable natural gas (RNG)
  - produce ammonium-sulfate fertilizer
  - produce 50,000 tons/year of biochar
  - produce some liquid argon and nitrogen using renewable power
  - safely store approximately 400,000 tons/year of CO_2 in an EPA Class VI geologic sequestration well

San Joaquin Renewables
NATURAL GAS FROM BIOMASS

- **Important Milestones**
  (from the perspective of the investor)
  - Technology validated
  - Site secured near McFarland, CA
  - Long term feedstock contracts signed
  - U.S. EPA D3 RIN pathway approved May 2020
  - Long term RNG offtake contracts signed
    - 5-million scf/day already contracted
    - in discussions for remaining volume
  - EPA Class VI sequestration well permit submitted for agency review

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Thank you!

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